DOCUMENT RESUME

ED 441 812 TM 030 846

AUTHOR Wisenbaker, Joseph M.; Douzenis, Cordelia
TITLE Web-Based Statistical Readings for an Introductory Statistics Course.
PUB DATE 2000-04-00
NOTE 13p.; Paper presented at the Annual Meeting of the American Educational Research Association (New Orleans, LA, April 24-28, 2000).
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Educational Research; *Graduate Students; Graduate Study; Higher Education; *Instructional Materials; *Resources; *Statistics; *World Wide Web

ABSTRACT

A collection of readings was developed to illustrate common statistical concepts through "real life" educational research situations. The collection, which was intended to focus on materials related to educational settings in Georgia, was prepared for college students in introductory statistics courses. The collection was developed through literature reviews and the examination of databases of research. Thirty-four graduate students in education took part in the evaluation of the readings list. There was considerable variation among the students in their perceptions of each of the nine readings as well as a lot of variation across them. Only one reading seemed to be evaluated poorly uniformly. This reading was probably the most like what one would find in a refereed journal. No one reading appeared likely to increase all students' interest in learning statistics. It is recommended that instructors avoid the temptation to use articles out of professional journals, and find instructional materials seen as relevant to teachers' day-to-day lives. (SLD)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 441 812

Web-Based Statistical Readings for an Introductory Statistics Course

Joseph M. Wisenbaker

University of Georgia

Cordelia Douzenis

Georgia Southern University

BEST COPY AVAILABLE

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

J. Wisenbaker

Presented at the Annual Meeting of the American Educational Research Association

April 24-28, 2000

New Orleans, LA

TM030846

Introduction

Almost all graduate students who work on master's, specialist, or doctoral degrees in education are required to learn how to conduct research in educational settings and how to evaluate the research that appears in professional journals. However, a substantial portion of the students in these classes neither attain an adequate mastery of statistics nor do they fully appreciate the role that statistical thinking plays in conducting studies and interpreting research literature. Far too many of them exit the courses with an overly simplistic and mechanical perception of the way that statistics work or the explicitly stated belief that the courses offer them nothing of value.

Watts (1991) indicated that one reason students have difficulty learning statistics is that "the important fundamental concepts of statistics are quintessentially abstract" (p. 290). Weaver (1989) supported this position that the abstract nature of statistical content limits comprehension. Without adequate comprehension, students are unable to recognize the importance and/or presence of statistics in everyday life, i.e., students fail to perceive the usefulness of the subject matter. According to Snee (1993), "people can't value what they don't understand" (p. 150). In recent years, many researchers (e.g., Fischer, 1996; Thompson, 1994; Weaver, 1992; Yilmaz, 1996) have emphasized the use of real-world applications in statistics courses in an effort to increase comprehension and, according to Sowey (1995), to demonstrate the "worthwhileness" of statistics.

Purpose of this Project

Almost all students at the University of Georgia and Georgia Southern University who work on master's, specialist or doctoral degrees in Education are required to learn how to conduct research in educational settings and how to evaluate the research that appears in professional journals. A required course at each institution involves the introduction of statistical methods applied to education research; typical course topics include central tendency, variability, distributions, tests of means, tests of relationships, etc.

Web-Based Statistical Readings for an Introductory Statistics Course

The purpose of the project that formed the basis for the work reported herein was to provide students a series of web-based statistical readings designed to illustrate common statistical concepts via "real-life" educational research situations. As these students were mostly active teachers and administrators in Georgia public schools, the collection of readings was intended to focus on materials explicitly related to educational settings in Georgia.

Identification of Materials

At the start of our project, we began an effort to locate potentially useful material from which to shape the readings. Our first efforts focused on trying to recruit submissions from fellow faculty members in Georgia's Board of Regents System. To that end we generated an e-mail list consisting of approximately 750 faculty members teaching in departments or colleges of education in system institutions. A letter describing the project and requesting submissions was e-mailed to everyone on that list. While a number of fellow faculty expressed an interest in our effort, eventually we received only three submissions only one of which was deemed appropriate for our project.

We next contacted the Innovation Grants office at the Georgia State Department of Education requesting copies of evaluation reports involving projects taking place in the public school system. From approximately 25 evaluation reports, we selected two as particularly promising and wrote summaries of those along with tables and charts most pertinent to the topics in our courses.

Having located a wealth of public school related data in the Georgia Public Education Report Card on the Georgia State Department of Education web-site (http://www.doe.k12.ga.us), we prepared two short summaries of data looking in one instance at a host of indicators in the largest school system and in the other instance at ITBS and student demographic characteristics in a number of schools located in southeast Georgia.

Finally, we located from our own files four public school or public school related projects in which we had been involved. These, too, were summarized with particularly relevant features given emphasis. Ultimately, our efforts resulted in the generation of nine readings. Titles, along with corresponding statistical concepts, are listed below:

Web-Based Statistical Readings for an Introductory Statistics Course

Defining Parental Involvement at the Elementary School Level [Oneway ANOVA]

A Study of Presidential Salaries at Georgia Public Colleges for FY99 [Frequency Distributions]

Evaluation of the A La Carte Science Program [Oneway ANOVA, t-tests]

Georgia Public Education Report Card: Gwinnett County Schools [Frequency Distributions]

Exploring Changes in Reading Proficiency [Frequency Distributions, Graphs]

Really Awesome Multimedia for Kids [Chi-square test]

Effects of Headings within Tests [ANCOVA]

Georgia Public Education Report Card: Correlational Analysis [Correlation Coefficients]

The Relationship Between Personality Characteristics & Quality of Learning in a Distance Ed. Course [Correlation Coefficients, Significance of r]

Evaluation of Readings

Graduate education students (n = 34) enrolled in introductory statistics classes at the University of Georgia and Georgia Southern University took part in the evaluation of our readings. A large portion of these students were enrolled in master's level programs with many indicating that the statistics course represented the last in their programs. Few were likely to progress toward a more advanced degree in the immediate future, and fewer still were interested in pursuing a career in higher education requiring the regular use of statistics.

The readings were made available to our students at Georgia Southern via WebCT, a web-based system for managing and retrieving information, and at the University of Georgia in printed form. After reviewing each report, students provided an assessment of the statistical reading via five statements which addressed areas such as usefulness, value and interest. The specific statements were as follows:

Item 1: Reading this helps me see better how statistics can be of use in an educational setting.

Item 2: Reading this helps me see how statistics can be of use in a research setting.

Item 3: Reading this helps me see ways that I might apply statistics in my own work.

Item 4: Reading this helps me better understand the value of statistics.

Item 5: Reading this helps increase my interest in learning statistics.

The assessment instrument also solicited additional comments from the students. Students were given extra credit for their participation in this activity.

Results

Table 1 displays the percentage of students agreeing or strongly agreeing with each of the items. When asked if the reading was a good example of how statistics can be of use in an educational setting (Item 1), approximately 80% or greater agreed for all articles except for "Effects of Headings within Tests." Item 3 questioned whether the respective readings were illustrative of the potential use of statistics in the student's own work setting. Results revealed that Item 3 (in comparison to the other items) had the lowest percentage of agreement for most of the readings with the "Exploring Changes in Reading Proficiency" receiving the greatest level of agreement (82.4%). Many respondents agreed that most of the readings demonstrated the value of statistics (Item 4); however, only four of the readings ("Presidential Salaries", "Gwinnett County", "Correlational Analysis" and "Reading Proficiency") were strongly endorsed as increasing their interest in learning statistics (Item 5).

Table 1

Percentage of Agreement with Survey Items

Article	Item1	Item2	Item3	Item4	Item5
Parental Involvement	90.6	81.3	65.6	84.4	59.4
Presidential Salaries	79.4	91.2	64.7	84.4	81.8
A La Carte Science	87.1	77.4	64.5	87.1	58.1
Gwinnett County	90.9	84.8	63.6	90.9	81.8
Reading Proficiency	100.0	94.1	82.4	97.1	76.5
Awesome Multimedia*	100.0	83.3	62.5	66.7	58.3
Effects of Headings	54.8	54.8	41.9	51.6	38.7
Correlational Analysis	87.5	87.5	71.9	81.3	78.1
Distance Education	81.3	90.6	50.0	65.6	53.1

*Rated only by University of Georgia Students
Note. Percentage represents those Strongly Agreeing or Agreeing with each statement.

Table 2 presents descriptive statistics for the survey responses by reading and by item. A summary of these results indicates that students reported that they understood the use and value of statistics in education to a great extent when reading reports that were directly related to the teaching profession (e.g., "Exploring Changes in Reading Proficiency"). However, students saw limited usefulness and had little interest regarding research and/or statistical analyses associated with higher education settings (e.g., "Effects of Headings with Tests"). In addition, students were more positive about readings containing primarily descriptive analyses.

Table 2

Descriptive Statistics for Survey Responses

Article	Item1	Item2	Item3	Item4	Item5
Parental Involvement					
Mean	1.75	1.94	2.09	1.84	2.38
SD	.62	.95	1.03	.85	.83
Presidential Salaries					
Mean	2.03	1.71	2.15	1.81	1.97
SD	.90	.97	1.02	.78	.92
A La Carte Science					
Mean	1.87	2.03	2.29	1.87	2.32
SD	.72	.66	.94	.62	.91
Gwinnett County					
Mean	1.45	1.82	2.12	1.73	1.91
SD	.75	.95	.99	.72	.91
Reading Proficiency					
Mean	1.35	1.65	1.79	1.62	2.00
SD	.49	.69	.73	.55	.85
Awesome Multimedia					
Mean	1.67	2.04	2.17	2.17	2.33
SD	.48	.81	.96	.82	.87
Effects of Headings					
Mean	2.32	2.26	2.68	2.61	2.87
SD	1.01	1.00	.98	.99	1.18
Correlational Analysis					
Mean	1.56	1.66	1.91	1.91	2.00
SD	.80	.70	.96	.78	.98
Distance Learning					
Mean	1.88	1.78	2.47	2.22	2.34
SD	.71	.61	.92	.83	.87

Note. Strongly Agree = 1; Agree = 2; Neutral = 3; Disagree = 4; Strongly Disagree = 5

A mixed-model repeated measures analysis of variance was performed using reading and items as factors in the design. Corrected tests for within-subjects effects (using Greenhouse-Geisser) resulted in statistically significant effects for Reading ($F = 8.24$, $p < .001$), Item ($F = 13.02$, $p < .001$), and the Reading x Item interaction ($F = 2.233$, $p = .012$).

Descriptive statistics (marginal mean and standard error) associated with the main effect of Reading are presented in Table 3. Only eight readings were included in the above analysis as no data was available for the Georgia Southern University students on one of the articles ("Really Awesome Multimedia"). Based on the marginal mean values, students awarded the most favorable ratings to Reading 5 ("Exploring Changes in Reading Proficiency"); Reading 6 ("The Effects of Headings within Tests") received the least favorable ratings.

Table 3

Descriptive Statistics for Readings

Reading Title	Mean	Std. Error
1. Defining Parental Involvement	2.00	.111
2. Presidential Salaries	1.93	.115
3. Evaluation of A La Carte Science	2.08	.086
4. Gwinnett County Schools	1.81	.117
5. Reading Proficiency	1.68	.084
6. Effects of Headings	2.55	.143
7. Correlational Analysis	1.81	.106
8. Personality/Distance Learning	2.14	.110

Note. A lower mean value represents a more favorable response.

Pairwise comparisons (Bonferroni) of the estimated marginal means revealed significant differences at the .05 level between Reading 6 and Readings 2, 4, 5, and 7. In addition, the mean difference between Readings 5 and 8 was significant.

Descriptive statistics associated with the main effect of Item are presented in Table 4. These statistics reflect the mean response to each survey item without regard to a specific reading. Students had the highest level of agreement with Item 1 (use of statistics in educational setting) and the lowest level of agreement with Item 5 (increased interest in learning statistics).

Table 4

Descriptive Statistics for Item

Item	Mean	Std. Error
Reading this helps me....		
1. See better how statistics can be of use in an educational setting.	1.78	.069
2. See how statistics can be of use in a research setting.	1.86	.089
3. See ways that I might apply statistics in my own work.	2.19	.094
4. Better understand the value of statistics.	1.95	.067
5. Increase my interest in learning statistics.	2.22	.095

Note. A lower mean value represents a more favorable response.

Pairwise comparisons (Bonferroni) of the estimated marginal means revealed significant differences at the .05 level of significance between Item 5 and Items 1, 2, and 4. Item 3 was significantly different from Items 1 and 2 and significance was also found in the comparison of Items 1 and 4.

Turning to an item-by-item consideration of the readings' ratings, the results regarding students' responses to the item "Reading this helps me see better how statistics can be of use in an educational setting" demonstrated that only two of the readings seemed to have been markedly less favorably evaluated -- "Presidential Salaries" and "Effects of Headings Within Tests."

The first of these is obviously somewhat remote from the standpoint of classroom education. The second seems to be dealing in a fairly abstract way with a topic having some potential relevance but using graduate students as subjects.

In terms of the second item "Reading this helps me see how statistics can be of use in a research setting", there were three articles less favorably evaluated -- "A La Carte Science", "Really Awesome Multimedia", and "Effects of Headings."

Considering both the third item "Reading this helps me see ways that I might apply statistics in my own work" and the fourth item "Reading this helps me better understand the value of statistics", "Parental Involvement", "Really Awesome Multimedia", "Distance Learning", and "Effects of Headings" had the poorest evaluations. Finally, looking at the last item "Reading this helps increase my interest in learning statistics", the most poorly evaluated article was "Effects of Headings."

Considering all of the items on which students provided judgements, it would seem reasonable to see as "best" the articles "Reading Proficiency", "Presidential Salaries", and "Gwinnett County." The article "Effects of Headings" was clearly the least favorably evaluated overall. Of those most highly rated, the only one that seems to be somewhat out of place was "Presidential Salaries." Students' interest in this may be simply an outgrowth of our general fascination with people's income - sort of an "Inquiring Minds Want to Know" effect.

Some students also provided open-ended comments regarding the statistical readings. Selected comments are listed below:

"I actually enjoyed reading this article, probably because it is a subject that I am excited about (Reading). Articles from students' areas of interest or majors may tend to increase the motivation to read and use statistics."

"Including statistics from familiar schools/school districts will even spark more interest."

"This article was of benefit because it demonstrated how statistics can be used to measure growth allowing schools to adjust curriculum and instruction as needed."

"This one [Effects of Headings within Tests] was kind of a boring topic; however, information was easy to understand."

Conclusions

While we made every effort to locate and include readings that focused specifically on research and data analysis involving educational settings in Georgia, there was considerable variation among the students in their perceptions of each of the readings as well as a lot of variation across them. The only reading that seemed to be uniformly poorly evaluated was "Effects of Headings Within Tests", the one that was probably most like what one might find in a refereed journal.

While several seemed to be strongly endorsed in terms of helping students see how statistics can be of use, there did not seem to be any one reading that would increase all students' interest in learning statistics. Based on this, one of our recommendations would be that students be exposed to a variety of readings in the hope that each student would find at least one of them to be particularly relevant. Furthermore, it may be that instructors of courses similar to ours but in other locations may need to create their own sets of readings to maximally appeal to their own audiences. For such instructors our recommendations would be to find materials easily seen as relevant to teachers' day-to-day lives and to avoid the temptation to use articles out of professional journals unless they are powerfully relevant to the student population in question.

References

Fischer, H. W. (1996). Teaching statistics from the user's perspective. Teaching Sociology, 24, 225-230.

Snee, R. D. (1993). What's missing in statistical education? The American Statistician, 47, 149-154.

Sowey, E. R. (1995). Teaching statistics: Making it memorable. Journal of Statistics Education [Online], 3(2). (http://www.amstat.org/publications/jse/v3n2/sowey.html)

Thompson, W. B. (1994) Making data analysis realistic: Incorporating research into statistics courses. Teaching of Psychology, 21, 41-43.

Watts, D. G. (1991). Why is introductory statistics difficult to learn? And what can we do to make it easier? The American Statistician, 45, 290-291.

Weaver, F. S. (1989). Introductory statistics: Questions, content, and approach. In F. S. Weaver (Ed.) Promoting inquiry in undergraduate learning. New Directions for Teaching and Learning, No. 38. San Francisco: Jossey-Bass.

Weaver, K. A. (1992). Elaborating selected statistical concepts with common experience. Teaching of Psychology, 19, 178-179.

Yilmaz, M. R. (1996). The challenge of teaching statistics to non-specialists. Journal of Statistics Education [Online], 4(1). (http://www.amstat.org/publications/jse/v4n1/yilmaz.html)